AMENDMENTS TO THE CLAIMS

In the claims:

Claims 1, 3, and 27-36 were the subject of the present Office Action. Claim 1 has been allowed. Please amend claims 27 and 32-35, cancel previously withdrawn claims 8-26 without prejudice, and add new claims 37-57, as shown in the following listing of claims, which will replace all prior versions and listings of claims in the application. Claims 8-26 were previously withdrawn from consideration as the result of a restriction requirement and are hereby canceled without prejudice to their pursuit in an appropriate continuation or divisional application.

Listing of claims:

1. (previously presented) An isolated or purified enzyme exhibiting nicotianamine synthase activity, wherein the enzyme comprises the polypeptide having an amino acid sequence of SEQ ID NO: 1.

2. (canceled)

3. (previously presented) The enzyme according to claim 27, wherein the enzyme comprises the consensus amino acid sequence of $_{199}$DVVFLAALVGM$_{209}$ (SEQ ID NO: 27).

4. – 26. (canceled)

27 (currently amended). An isolated or purified enzyme exhibiting nicotianamine synthase activity, wherein the enzyme:

a. is a polypeptide having at least 50% identity with an amino acid sequence of SEQ ID NO: 1, comprising at least one consensus sequence of SEQ ID NO: 1 that is:

(1) $_{25}$LPXLSPSPXVDRLFTXLVXACVPXSPVDVTKL$_{56}$ (SEQ ID NO: 23)

(2) $_{67}$LIRLCSXAEGXLEAHY$_{82}$ (SEQ ID NO: 24)

(3) $_{92}$PLDHLGXFPY$_{101}$ (SEQ ID NO: 25)

(4) $_{128}$VAFXGSGPLPFSS$_{140}$ (SEQ ID NO: 26)

(5) $_{199}$DVVFLAALVGM$_{209}$ (SEQ ID NO: 27)

(6) $_{253}$RGGFXVLAVXHP$_{264}$ (SEQ ID NO: 28); and

b. has more than 25% of the relative nicotianamine synthase activity of ~~an equivalent amount of the nicotianamine synthase activity of~~ the enzyme of SEQ ID NO:1.

28 (previously presented). The enzyme of claim 27, wherein the polypetide further comprises all of the conserved amino acid residues of SEQ ID NO: 1 that is:

L(11), K(14), I(15), I(22), L(25), L(28), P(30), L(37), F(38), L(41), V(42), C(45), P(47), D(52), V(53), Q(61), M(63), R(64), L(67), I(68), C(71), A(74), E(75), L(78), E(79), H(81), L(86), D(90), P(92), L(93), H(95), L(96), F(99), P(100), Y(101), N(104), Y(105), L(108), L(111), E(112), L(115), L(116), A(129), F(130), G(132), S(133), G(134), P(135), L(136), P(137), S(140), L(143), A(144), H(147), L(148), F(153), N(155), A(162), N(163), A(166), L(169), R(180), M(181), F(183), T(185), L(195), D(199), V(200), V(201), F(202), L(203), A(204), A(205), V(207), G(208), M(209), K(214), H(220), L(221), H(224), M(225), G(228), A(229), L(231), R(239), F(241), L(242), Y(243), P(244), V(246), G(255), F(256), V(258), L(259), V(261), H(263), P(264), V(268), N(270), S(271), K(277) (SEQ ID NO: 29).

29 (previously presented). The enzyme of claim 27, wherein the polypeptide has more than 90% identity with an amino acid sequence of SEQ ID NO: 1.

30 (previously presented). The enzyme of claim 27, wherein the polypeptide has more than 95% identity with an amino acid sequence of SEQ ID NO: 1.

31 (previously presented). The enzyme of claim 27, wherein the nicotianamine synthase activity is measured in an assay in a comparison with the enzyme of SEQ ID NO:1.

32 (previously presented). The enzyme of claim 27, wherein the enzyme:

i. is isolated or purified from a plant; or

ii. is expressed directly or indirectly from a nucleic acid isolated or purified from a plant; or

iii. is expressed directly or indirectly from a chimeric nucleic acid at least partially isolated or purified from a plant.

33 (previously presented) The enzyme of claim [[32,]] 27, wherein the enzyme is isolated or purified from barley.

34. (previously presented) The enzyme of claim [[32,]] 27, wherein said enzyme is isolated or purified from Oryza sativa.

35 (currently amended). A mutated enzyme exhibiting nicotianamine synthase activity, wherein the enzyme:

a. is a polypeptide having more than [[90%]] 95% identity with an amino acid sequence of SEQ ID NO: 1, comprising at least one consensus sequence of SEQ ID NO: 1 that is:

(1) $_{25}$LPXLSPSPXVDRLFTXLVXACVPXSPVDVTKL$_{56}$ (SEQ ID NO: 23)

(2) $_{67}$LIRLCSXAEGXLEAHY$_{82}$ (SEQ ID NO: 24)

(3) $_{92}$PLDHLGXFPY$_{101}$ (SEQ ID NO: 25)

(4) $_{128}$VAFXGSGPLPFSS$_{140}$ (SEQ ID NO: 26)

(5) $_{199}$DVVFLAALVGM$_{209}$ (SEQ ID NO: 27)

(6) $_{253}$RGGFXVLAVXHP$_{264}$ (SEQ ID NO: 28); and

b. has more than 25% of the relative nicotianamine synthase activity of ~~an equivalent amount of the nicotianamine synthase activity of~~ the enzyme of SEQ ID NO:1.

36 (previously presented). The enzyme of claim 35, wherein the polypetide further comprises all of the conserved amino acid residues of SEQ ID NO: 1 that is:

L(11), K(14), I(15), I(22), L(25), L(28), P(30), L(37), F(38), L(41), V(42), C(45), P(47), D(52), V(53), Q(61), M(63), R(64), L(67), I(68), C(71), A(74), E(75), L(78), E(79), H(81), L(86), D(90), P(92), L(93), H(95), L(96), F(99), P(100), Y(101), N(104), Y(105), L(108), L(111), E(112), L(115), L(116), A(129), F(130), G(132), S(133), G(134), P(135), L(136), P(137), S(140), L(143), A(144), H(147), L(148), F(153), N(155), A(162), N(163), A(166), L(169), R(180), M(181), F(183), T(185), L(195), D(199), V(200), V(201), F(202), L(203), A(204), A(205), V(207), G(208), M(209), K(214), H(220), L(221), H(224), M(225), G(228), A(229), L(231), R(239), F(241), L(242), Y(243), P(244), V(246), G(255), F(256), V(258), L(259), V(261), H(263), P(264), V(268), N(270), S(271), K(277) (SEQ ID NO: 29).

37 (new). The enzyme of claim 35, wherein the nicotianamine synthase activity is measured in an assay in a comparison with the enzyme of SEQ ID NO:1.

38 (new). The enzyme of claim 35, wherein the polypeptide has more than 97% identity with an amino acid sequence of SEQ ID NO: 1.

39 (new). The enzyme of claim 27, wherein the polypeptide has more than 97% identity with an amino acid sequence of SEQ ID NO: 1.

40 (new). The enzyme of claim 27, wherein the enzyme is isolated or purified from a plant, either as a polypeptide or as a nucleic acid, which is used to express a polypeptide.

41 (new). An isolated, purified, or mutated enzyme exhibiting nicotianamine synthase activity, wherein the enzyme comprises an active fragment of an amino acid sequence of SEQ ID NO: 1, the active fragment comprising a polypeptide, wherein the polypeptide:

a. comprises at least one consensus sequence of SEQ ID NO: 1 that is:

(1) $_{25}$LPXLSPSPXVDRLFTXLVXACVPXSPVDVTKL$_{56}$ (SEQ ID NO: 23)

(2) $_{67}$LIRLCSXAEGXLEAHY$_{82}$ (SEQ ID NO: 24)

(3) $_{92}$PLDHLGXFPY$_{101}$ (SEQ ID NO: 25)

(4) $_{128}$VAFXGSGPLPFSS$_{140}$ (SEQ ID NO: 26)

(5) $_{199}$DVVFLAALVGM$_{209}$ (SEQ ID NO: 27)

(6) $_{253}$RGGFXVLAVXHP$_{264}$ (SEQ ID NO: 28); and

b. has more than 25% of the relative nicotianamine synthase activity of the enzyme of SEQ ID NO:1.

42 (new). The enzyme of claim 27 or claim 41, wherein said enzyme is isolated or purified from Arabidopsis thaliana.

43 (new). An isolated or purified barley enzyme exhibiting nicotianamine synthase activity, wherein:

a. the enzyme is:

i. isolated or purified from barley; or

ii. expressed directly or indirectly from a nucleic acid isolated or purified from barley; or

iii. expressed directly or indirectly from a chimeric nucleic acid at least partially isolated or purified from barley;

b. the enzyme comprises a polypeptide having at least 50% identity with an amino acid sequence of SEQ ID NO: 1, comprising at least one consensus sequence of SEQ ID NO: 1 that is:

(1) $_{25}$LPXLSPSPXVDRLFTXLVXACVPXSPVDVTKL$_{56}$ (SEQ ID NO: 23)

(2) $_{67}$LIRLCSXAEGXLEAHY$_{82}$ (SEQ ID NO: 24)

(3) $_{92}$PLDHLGXFPY$_{101}$ (SEQ ID NO: 25)

(4) $_{128}$VAFXGSGPLPFSS$_{140}$ (SEQ ID NO: 26)

(5) $_{199}$DVVFLAALVGM$_{209}$ (SEQ ID NO: 27)

(6) $_{253}$RGGFXVLAVXHP$_{264}$ (SEQ ID NO: 28); and

c. the enzyme has more than 25% of the relative nicotianamine synthase activity of the enzyme of SEQ ID NO:1.

44 (new). The enzyme of claim 43, wherein the polypetide further comprises all of the conserved amino acid residues of SEQ ID NO: 1 that is:

L(11), K(14), I(15), I(22), L(25), L(28), P(30), L(37), F(38), L(41), V(42), C(45), P(47), D(52), V(53), Q(61), M(63), R(64), L(67), I(68), C(71), A(74), E(75), L(78), E(79), H(81), L(86), D(90), P(92), L(93), H(95), L(96), F(99), P(100), Y(101), N(104), Y(105), L(108), L(111), E(112), L(115), L(116), A(129), F(130), G(132), S(133), G(134), P(135), L(136), P(137), S(140), L(143), A(144), H(147), L(148), F(153), N(155), A(162), N(163), A(166), L(169), R(180), M(181), F(183), T(185), L(195), D(199), V(200), V(201), F(202), L(203), A(204), A(205), V(207), G(208), M(209), K(214), H(220), L(221), H(224), M(225), G(228), A(229), L(231), R(239),

F(241), L(242), Y(243), P(244), V(246), G(255), F(256), V(258), L(259), V(261), H(263), P(264), V(268), N(270), S(271), K(277) (SEQ ID NO: 29).

45 (new). The enzyme of claim 43, wherein the polypeptide has more than 90% identity with an amino acid sequence of SEQ ID NO: 1.

46 (new). The enzyme of claim 43, wherein the polypeptide has more than 95% identity with an amino acid sequence of SEQ ID NO: 1.

47 (new). The enzyme of claim 43, wherein the nicotianamine synthase activity is measured in an assay in a comparison with the enzyme of SEQ ID NO:1.

48 (new). An isolated or purified enzyme exhibiting nicotianamine synthase activity, wherein:

a. the enzyme is:

i. isolated or purified from rice; or

ii. expressed directly or indirectly from a nucleic acid isolated or purified from rice; or

iii. expressed directly or indirectly from a chimeric nucleic acid at least partially isolated or purified from rice;

b. the enzyme comprises a polypeptide having at least 50% identity with an amino acid sequence of SEQ ID NO: 1, comprising at least one consensus sequence of SEQ ID NO: 1 that is:

(1) $_{25}$LPXLSPSPXVDRLFTXLVXACVPXSPVDVTKL$_{56}$ (SEQ ID NO: 23)

(2) $_{67}$LIRLCSXAEGXLEAHY$_{82}$ (SEQ ID NO: 24)

(3) $_{92}$PLDHLGXFPY$_{101}$ (SEQ ID NO: 25)

(4) $_{128}$VAFXGSGPLPFSS$_{140}$ (SEQ ID NO: 26)

(5) $_{199}$DVVFLAALVGM$_{209}$ (SEQ ID NO: 27)

(6) $_{253}$RGGFXVLAVXHP$_{264}$ (SEQ ID NO: 28); and

c. the enzyme has more than 25% of the relative nicotianamine synthase activity of the enzyme of SEQ ID NO:1.

49 (new). The enzyme of claim 48, wherein the polypetide further comprises all of the conserved amino acid residues of SEQ ID NO: 1 that is:

L(11), K(14), I(15), I(22), L(25), L(28), P(30), L(37), F(38), L(41), V(42), C(45), P(47), D(52), V(53), Q(61), M(63), R(64), L(67), I(68), C(71), A(74), E(75), L(78), E(79), H(81), L(86), D(90), P(92), L(93), H(95), L(96), F(99), P(100), Y(101), N(104), Y(105), L(108), L(111), E(112), L(115), L(116), A(129), F(130), G(132), S(133), G(134), P(135), L(136), P(137), S(140), L(143), A(144), H(147), L(148), F(153), N(155), A(162), N(163), A(166), L(169), R(180), M(181), F(183), T(185), L(195), D(199), V(200), V(201), F(202), L(203), A(204), A(205), V(207), G(208), M(209), K(214), H(220), L(221), H(224), M(225), G(228), A(229), L(231), R(239), F(241), L(242), Y(243), P(244), V(246), G(255), F(256), V(258), L(259), V(261), H(263), P(264), V(268), N(270), S(271), K(277) (SEQ ID NO: 29).

50 (new). The enzyme of claim 48, wherein the polypeptide has more than 90% identity with an amino acid sequence of SEQ ID NO: 1.

51 (new). The enzyme of claim 48, wherein the polypeptide has more than 95% identity with an amino acid sequence of SEQ ID NO: 1.

52 (new). The enzyme of claim 48, wherein the nicotianamine synthase activity is measured in an assay in a comparison with the enzyme of SEQ ID NO:1.

53 (new). An isolated or purified enzyme exhibiting nicotianamine synthase activity, wherein:

a. the enzyme is:

i. isolated or purified from Arabidopsis thaliana; or

ii. expressed directly or indirectly from a nucleic acid isolated or purified from Arabidopsis thaliana; or

iii. expressed directly or indirectly from a chimeric nucleic acid at least partially isolated or purified from Arabidopsis thaliana;

b. the enzyme comprises a polypeptide having at least 50% identity with an amino acid sequence of SEQ ID NO: 1, comprising at least one consensus sequence of SEQ ID NO: 1 that is:

(1) $_{25}$LPXLSPSPXVDRLFTXLVXACVPXSPVDVTKL$_{56}$ (SEQ ID NO: 23)

(2) $_{67}$LIRLCSXAEGXLEAHY$_{82}$ (SEQ ID NO: 24)

(3) $_{92}$PLDHLGXFPY$_{101}$ (SEQ ID NO: 25)

(4) $_{128}$VAFXGSGPLPFSS$_{140}$ (SEQ ID NO: 26)

(5) $_{199}$DVVFLAALVGM$_{209}$ (SEQ ID NO: 27)

(6) $_{253}$RGGFXVLAVXHP$_{264}$ (SEQ ID NO: 28); and

c. the enzyme has more than 25% of the relative nicotianamine synthase activity of the enzyme of SEQ ID NO:1.

54 (new). The enzyme of claim 53, wherein the polypetide further comprises all of the conserved amino acid residues of SEQ ID NO: 1 that is:

L(11), K(14), I(15), I(22), L(25), L(28), P(30), L(37), F(38), L(41), V(42), C(45), P(47), D(52), V(53), Q(61), M(63), R(64), L(67), I(68), C(71), A(74), E(75), L(78), E(79), H(81), L(86), D(90), P(92), L(93), H(95), L(96), F(99), P(100), Y(101), N(104), Y(105), L(108), L(111), E(112), L(115), L(116), A(129), F(130), G(132), S(133), G(134), P(135), L(136), P(137), S(140), L(143), A(144), H(147), L(148), F(153), N(155), A(162), N(163), A(166), L(169), R(180), M(181), F(183), T(185), L(195), D(199), V(200), V(201), F(202), L(203), A(204), A(205), V(207), G(208), M(209), K(214), H(220), L(221), H(224), M(225), G(228), A(229), L(231), R(239), F(241), L(242), Y(243), P(244), V(246), G(255), F(256), V(258), L(259), V(261), H(263), P(264), V(268), N(270), S(271), K(277) (SEQ ID NO: 29).

55 (new). The enzyme of claim 53, wherein the polypeptide has more than 90% identity with an amino acid sequence of SEQ ID NO: 1.

56 (new). The enzyme of claim 53, wherein the polypeptide has more than 95% identity with an amino acid sequence of SEQ ID NO: 1.

57 (new). The enzyme of claim 53, wherein the nicotianamine synthase activity is measured in an assay in a comparison with the enzyme of SEQ ID NO:1.